University of Bahrain
College of Information Technology
Department of Information Systems
ITIS 216 – Database Management Systems
First Semester 2012/2013
Test I – October 23th 2012

Q1/20	Q2/15	Q3/15	Total/50
19	14	11	44

Name: M.G.S @UOB-BH Id_No: _____ Serial No: _____

Question 1 (The Relational Model) 1/2 // 10 Points

(1 mark each)

T 1. View is a virtual relation that does not necessarily actually exist in the database but is produced upon request, at time of request. T

T 2. If foreign key exists in a relation, either foreign key value must match a candidate key value of some tuple in its home relation or foreign key value must be wholly NULL. T

F 3. CK is a FK which doesn't have repeated values nor does it comes with a NULL value in the table.

F 4. Conceptual Schema Level is a Representation of data as viewed by End users.

T 5. (R – S) defines a relation consisting of the tuples that are in relation R, but not in S.

6. What is the difference between a base relation and a view?

base relation contains the data in the database,
View: dynamic result of relational operations operating in a base relation to produce another relation and it's a query on one or more base relations.

7. What is null? And what is the entity integrity rule or constraint?

null is unknown value, that is not zero and not space.
in a database

rule: PK attribute must not be NULL ((any record of PK)).

8. What is the difference between a primary key and a foreign key?

PK: an unique identifier for one attribute in a relation to uniquely identifies the records.

FK: an attribute in a relation that is related to a primary key or candidate-key in it's home relation.

9. What is the referential integrity rule or constraint?

if Foreign Key exists in a relation, either Foreign Key value must match a candidate Key value of some tuple in its home relation or Foreign Key value must be wholly NULL.

10. Given the three sets A={a,b}, B={x,y}, and C={1,2}. What's the Cartesian product A × B × C?

A×B×C = {(a,x,1), (a,x,2), (a,y,1), (a,y,2), (b,x,1), (b,x,2), (b,y,1), (b,y,2)}

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Question 1 (Relational Model) 2/2 // 10 Points

Relation **CUSTOMERS**

Fname	Lname	IdNo	Account
Roby	Banks	901-222	12345
Lena	Hand	805-333	12345
Lena	Hand	805-333	23456

Relation **Accounts**

AcctNo	Type	Balance
12345	Saving	12000
23456	Checking	1000
34567	Saving	25

3x2x1=6

Customers and Accounts Relations are part of a Banking database. Answer the following: (1 mark each)

1. The attributes of **CUSTOMERS** relation?
   Fname, Lname, IdNo, Account
2. The tuples of **Accounts** relation?
   {(12345, "Saving", 12000), (23456, "checking", 1000), (34567, "saving", 25)} 3
3. The relation Schema for relation **Accounts**?
   Accounts (AcctNo: Integer, Type: string, Balance: Integer)
4. The database Schema?
   CUSTOMERS (Fname, Lname, IdNo, Account)
   Accounts (AcctNo, Type, Balance)
5. The degree of relation **CUSTOMERS** is?
   4

9 6. The cardinality of relation **Accounts** is?
   3
7. The domain of attributes Fname, Lname?
   Fname character of size 10
   Lname character of size 10
8. The Candidate Keys of relation **Accounts** are?
   AcctNo, Balance
9. The Foreign Key of relation **Accounts** is?
   Account
10. The Super Keys of relation **Accounts** are?
    Super Keys = {AcctNo}, {AcctNo, Type}, {AcctNo, Type, Balance}, {AcctNo, Balance}, {Balance}, {Balance, Type}

Question 2 (SQL) // 15 Points

Based on the following Factory's DB schema and the sample data for the relations on page 6, Show the output result of the following SQL queries? (5 marks each)

The DB is composed of 4 tables: Product, PC, Laptop and Printer. Refer to Page-6

Product (Maker, Model, Type)
PC (Model, Speed, Ram, Hd, Price)
Laptop (Model, Speed, Ram, Hd, Screen, Price)
Printer (Model, Color, Type, Price)

Product Relation: gives the manufacturer, model number, and type(PC, Laptop, or Printer) of various products. Assume that model numbers are unique over all manufacturers and product types.

PC Relation: gives a model number for each PC. Also, It gives speed in GHZ, the amount of RAM in MB, the size of HD (Harddisk)in GB and the Price.

Laptop Relation: is similar to PC relation but it also gives screen Size in inches.

Printer Relation: records for each printer model whether the printer produces color output (True/False) and the Type (Laser, or Inkjet), and also gives the Price.

1.

```
SELECT *
FROM Printer
WHERE type= "ink-jet";
```

model	color	type	price
3001	true	ink-jet	99
3004	true	ink-jet	120
3006	true	ink-jet	200

2.

```
SELECT model, hd
FROM PC
WHERE speed = 3.2 OR price < 2000;
```

model	hd
1002	250
1003	80
1004	250
1005	250
1006	320
1007	200
1008	250
1009	250
1010	300
1011	160
1012	160
1013	90

3.

```
SELECT R.maker AS manufacturer,
       L.speed AS gigahertz
FROM Product R, Laptop L
WHERE L.hd >= 30 AND R.model = L.model ;
```

manufacturer	gigahertz
A	2.00
A	2.16
A	2.00
B	1.83
E	2.00
E	1.73
E	1.80
F	1.60
F	1.60
G	2.00

Question 3 (Relational Algebra)1/2 // 5 Poi

Based on the following Factory's DB schema in Page-3, Write proper Relational Algebra queries for the following expressions?

1. What Laptop models have a Price greater than 100?

$R_1 = \Pi_{model}$

$R_2 = \sigma_{price > 100}(Laptop)$

$R_3 = R_1(R_3)$

$\Pi_{model}(\sigma_{price > 100}(Laptop))$

2. What Printer models have a Laser Printer type?

$R_1 = \Pi_{model}$

$R_2 = \sigma_{type='laser'}(Printer)$

$R_3 = R_1(R_2)$

4

$\Pi_{model}(\sigma_{type='laser'}(Printer))$

3. What Product manufacturer have a model of 3007?

$R_1 = \Pi_{maker}$

$R_2 = \sigma_{model=3007}(Product)$

$R_3 = R_1(R_2)$

$\Pi_{maker}(\sigma_{model=3007}(Product))$

4. List all Product manufacturers who produced PC types or Printer types? (2 marks)

$R_1 = \sigma_{type='PC' \text{ OR } type='printer'}(Product)$

$R_2 = \Pi_{maker}$

$R_3 = R_2(R_1)$

1

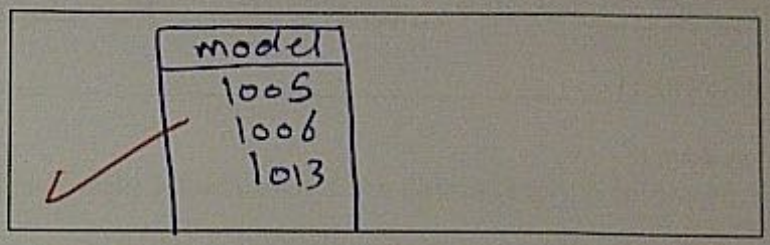
$\Pi_{maker}(\sigma_{type='PC' \text{ OR } type='Printer'}(Product))$

Question 3 (Relational Algebra) 2/2 M.G.S @UOB-BH // 10 Points

Based on the schema of Question (3) and the sample data for the relations on page 5, Show the output result of the following Relational Algebra Queries? (2 marks each)

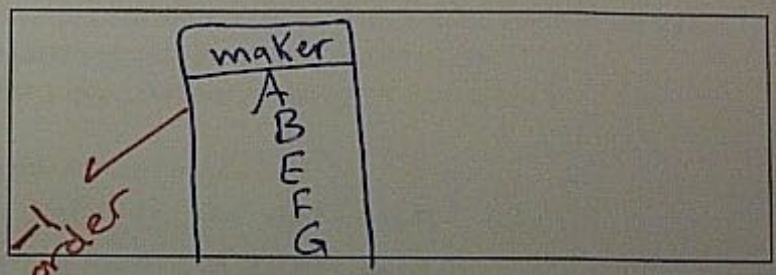
1.

$R1 := \sigma_{speed \geq 3.00}(PC)$
$R2 := \pi_{model}(R1)$
$\pi_{model}(\sigma_{speed \geq 3.00}(PC))$



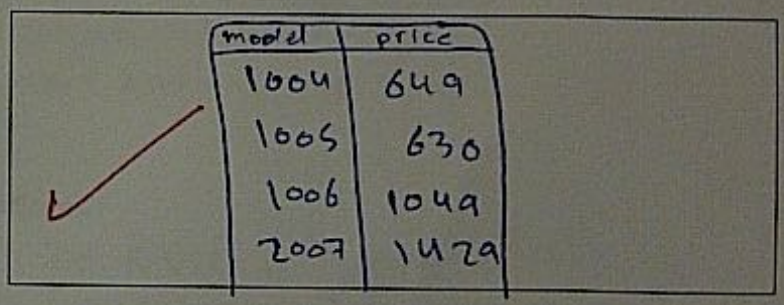
2.

R1 := σhd ≥ 100 (Laptop)
R2 := Product ⋈ (R1)
R3 := πmaker (R2)
$\pi_{maker}(Product \bowtie \sigma_{hd \geq 100}(laptop))$



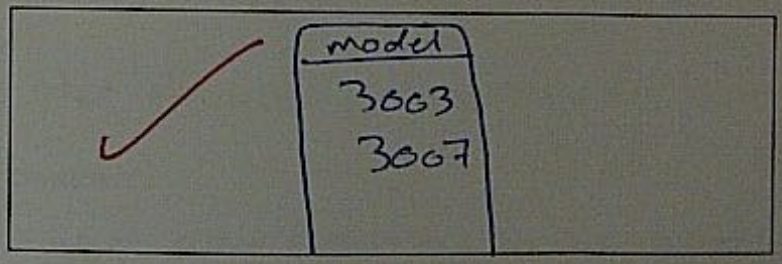
3.

R1 := σmaker=B (Product ⋈ PC)
R2 := σmaker=B (Product ⋈ Laptop)
R3 := σmaker=B (Product ⋈ Printer)
R4 := πmodel,price (R1)
R5 := πmodel,price (R2)
R6: = πmodel,price (R3)
R7 := R4 ∪ R5 ∪ R6



4.

R1 := σcolor = true AND
type = laser (Printer)
R2 := πmodel (R1)
$\pi_{model}(\sigma_{color=true\ AND\ type=laser}(Printer))$



5.

R1 := σtype=laptop (Product)
R2 := σtype=PC(Product)
R3 := πmaker(R1).
R4 := πmaker(R2)
R5 := R3 – R4